

### Abstract of the Disclosure

5            Microparticles 8 includes an optical substrate 10 having at least one diffraction  
grating 12 disposed therein. The grating 12 having a plurality of colocated pitches  $\Lambda$   
which represent a unique identification digital code that is detected when illuminated  
by incident light 24. The incident light 24 may be directed transversely from the side  
of the substrate 10 with a narrow band (single wavelength) or multiple wavelength  
source, in which case the code is represented by a spatial distribution of light or a  
wavelength spectrum, respectively. The code may be digital binary or may be other  
10        numerical bases. The micro-particles 8 can provide a large number of unique codes,  
e.g., greater than 67 million codes, and can withstand harsh environments. The micro-  
particles 8 are functionalized by coating them with a material/substance of interest,  
which are then used to perform multiplexed experiments involving chemical  
processes, e.g., DNA testing and combinatorial chemistry.